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Source(s)	Su Chang Chae, Young-il Kim, Hyunjae Kim schae@etri.re.kr ETRI Kyu Ha Lee, Changyun Kim, Yong Wook Lee kyuha.lee@samsung.com SAMSUNG THALES
Re:	Call for Technical Proposals regarding IEEE project P802.16j
Abstract	Propose hybrid relay structure having a demodulation and forwarding region and decoding and forwarding region within a single frame in RS.
Purpose	Adoption of the proposed text and tables
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Hybrid Relay Structure within a Single Frame

Su Chang Chae, Young-il Kim, Hyunjae Kim, Kyu Ha Lee, Changyun Kim*, Yong Wook Lee**

*ETRI, SAMSUNG THALES**

1. Introduction

We propose the hybrid relay structure to efficiently forward within a single frame. Our hybrid relay structure has two forwarding method which are demodulation and forwarding method and decoding and forwarding method within a single frame.

In general, the latency of channel decoding is much longer than that of demodulation because channel decoding and coding performs the burst by burst for user data and (de)modulation performs the symbol by symbol for FFT and etc. Therefore, we may additionally employ the demodulation and forwarding method to minimize the overall latency of modem in RS within a single frame.

Finally, we need to define the decoding and forward region and demodulation and forward region as capability of RS and its negotiation parameters.

2. Suggested Remedy

2.1 Hybrid Relay Structure

In general, relay structure for applying to the 2-Hop system has three regions, which are consist of BS-to-RS, BS-to-MS and RS-to-MS region like Figure-1.

And we would like to divide BS-to-RS region to demod+dec region and demod region, and RS-to-MS region to mod region and enc+mod region. Thus, our relay structure has 5 regions due to the demodulation and forwarding method.

The received signals in the demod+dec region is demodulated and decoded by RS and then forwarded regenerated signals through the enc+mod region to MS.

And the received signals in the demod region is just demodulated by RS and directly forwarded regenerated signals through the mod region to MS.

By the way, BS-to-RS region is necessary for GAP region which do not cause the transmission in RS. So, GAP region can be applied to BS-to-MS links

In the RS, It takes about 1+1/3 symbol time for demodulation procedure of FFT processing and symbols de-mapping and about 2/3 symbol time for modulation procedure of symbol mapping and IFFT processing.

After all, we can know that GAP can be decreased down to 2 symbols time due to the total processing time of demodulation and modulation at the demod and mod region of Figure-2.

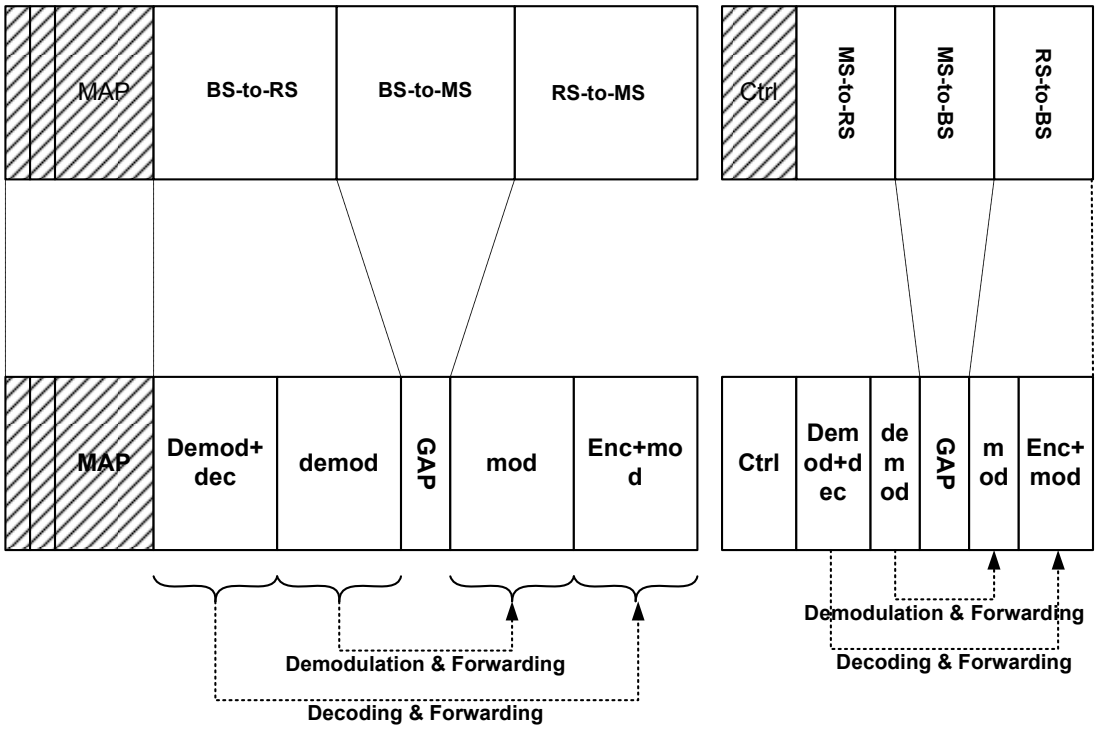

Figure-1 General Relay Structure in 2-Hop relay system (upper)
Figure-2 Proposed Hybrid Relay Structure in 2-Hop relay system (lower)

2.2 Usage Scenario

Figure-3 shows you usage scenario considering Hybrid Relay structure. There are three kinds of MS(s) which are in the good channel, coverage hole and coverage extension area.

The MS(s) in the good channel can be applied to GAP region of Hybrid Relay structure. The MS(s) in the coverage hole can be applied to demodulation and forwarding region in the hybrid relay structure. And coverage extension can be applied to decoding and forwarding region of hybrid relay structure.

For example, in the case of using the demodulation and forwarding method in RS for downlink, you can see that dark blue colored line indicates BS-to-RS links and light blue colored line indicates RS-to-MS links. It has not changed code rate, but modulation type of 64 QAM may be changed by QPSK to forward to MS.

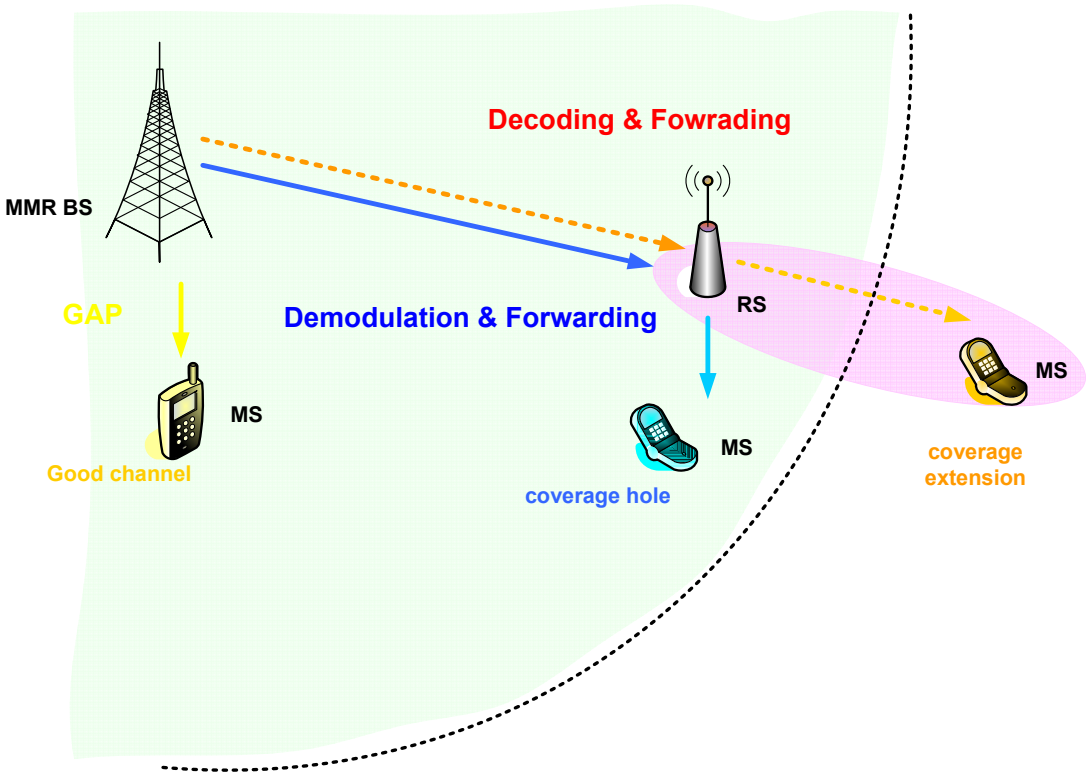

Figure-3 Usage Scenario for hybrid Relay Structure in 2-Hop Relay system

2.3 Operation Scenario

In the Figure-2, demod and mod region can indicate to direct region because those regions of received signal should not perform channel decoding and encoding. And also, demod+dec and enc+mod region can indicate to normal region because those regions of received signal should perform demodulation and channel decoding and then encoding and modulation.

Normal region, direct region and GAP region can have a variety of sizes according to the status of three kinds of channel status which have coverage extension and coverage holes in the RS-to-MS links and good channel status in the BS-to-MS links.

For the first time, for MS in the coverage extension, we would like to depict burst allocation for RS and MS respectively like Figure-4. we may allocate burst#1's MCS to 16QAM, 3/4 code rate and burst#2's MCS to QPSK, 1/2 code rate assuming that channel status of BS-to-RS links is much better than that of RS-to-MS links.

And for MS in the coverage holes, we would like to depict burst allocation for RS and MS respectively like Figure-5. We may allocate burst#3's MCS to 16QAM, 1/2 code rate and burst#4's MCS to QPSK, 1/2 code rate assuming that channel status of BS-to-RS links is much better than that of RS-to-MS links.

Figure-6 depicts that BS-to-MS links is applied to GAP region without RS because MS(s) is in a good channel status.

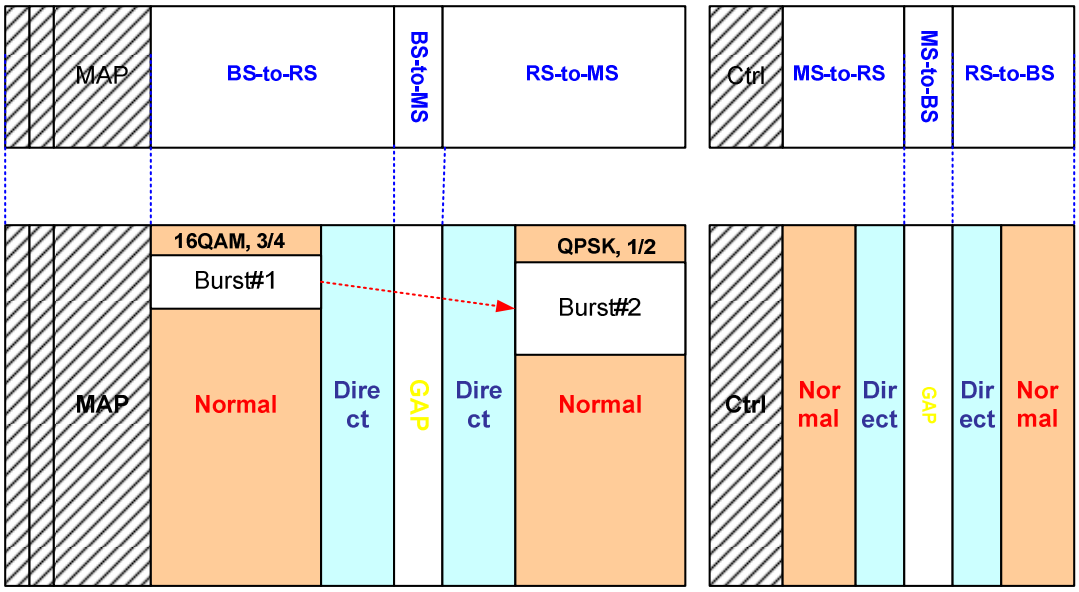

Figure-4 Operating Scenario for example to applying Normal region to coverage extension

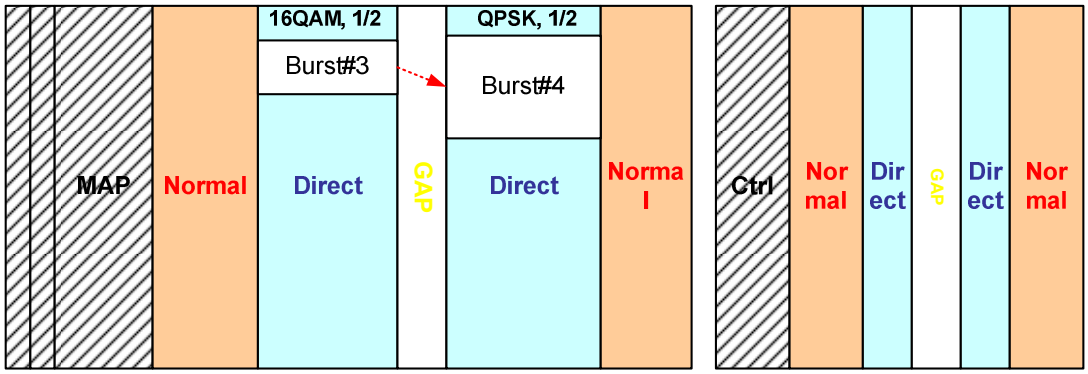

Figure-5 Scenario for example to applying Direct region to coverage extension

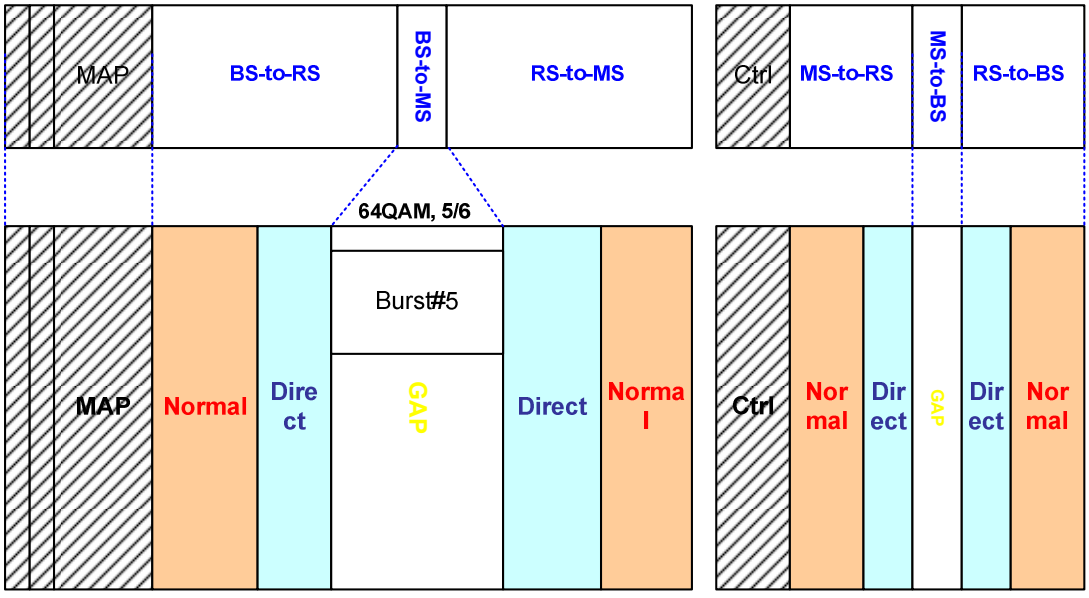

Figure--6 Scenario for example to applying GAP region to good channel

3. Proposed Technical Text

[Insert the following this entry at PHY wirelessMAN-OFDMA]

8.4.4.8 Relaying frame structure

[Insert the following this entry at PHY wirelessMAN-OFDMA]

8.4.4.8.1 Hybrid Relay Structure

[Insert the following technical text at PHY wirelessMAN-OFDMA]

The hybrid relay structure may include 5 regions (such as demod+dec, demod, gap, mod, enc+mod region). The hybrid relay structure may support two forwarding method which are demodulation and forwarding method and decoding and forwarding method.

Demod+dec region means that RS performs demodulation and channel decoding for BS-to-RS signals. Demod region means that RS performs only demodulation for BS-to-RS signals. mod region means that RS performs only modulation for RS-to-MS signals. Enc+mod region means that RS performs channel encoding and modulation for RS-to-MS signals.

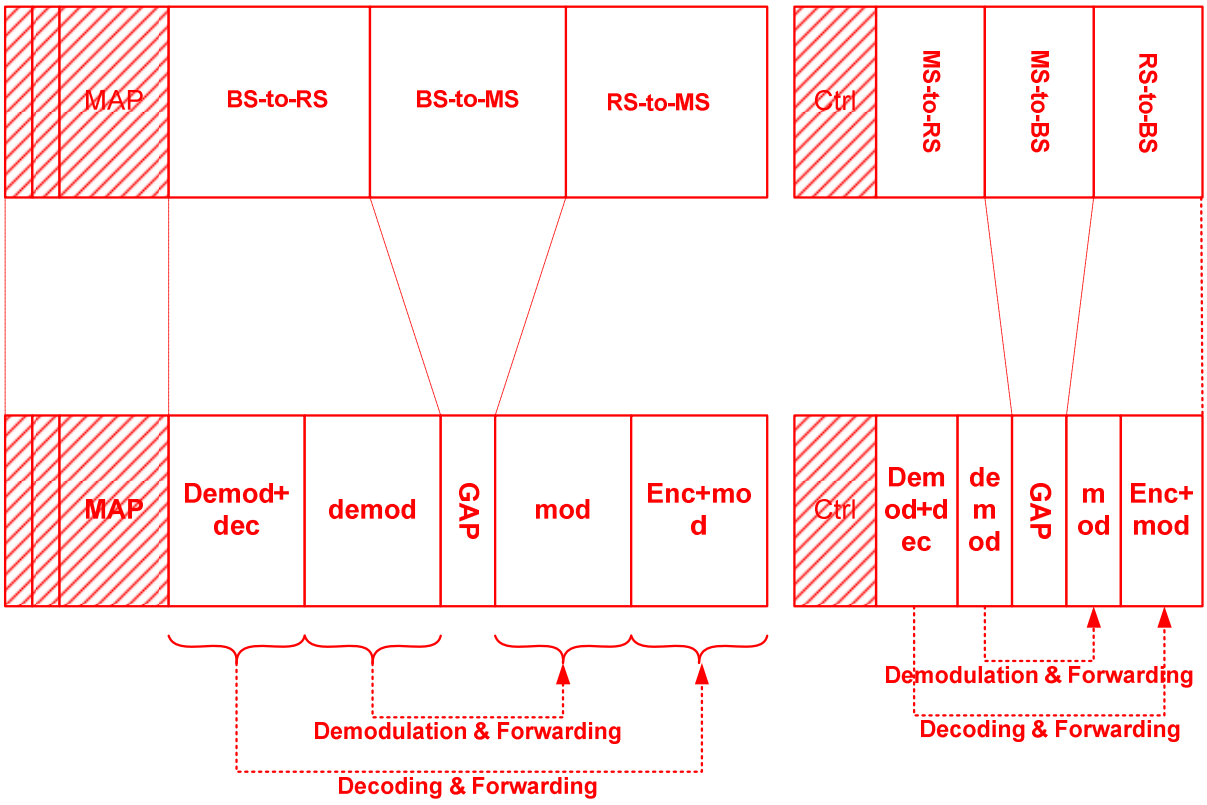

Figure-aaa Hybrid Relay Structure in 2-Hop System.

11.3 UCD management message encdings

11.3.1 UCD channel encodings

[Change Table 349 in 11.3.1 "UCD channel encodings", as shown:]

Table 349-UCD channel encoding

Name	Type (1 byte)	Length	Value(variable length)	PHY scope

UL region	34	*variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Demod+dec region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Demod region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Mod region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Enc+mod region	?	*variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Gap region	?	*variable*	Num region(6bits for the number of regions, 2 bit reserved) For (i=0; i< Num region; i++){ OFDMA symbol offset(8bits) subchannel offset(6bits) No. OFDMA symbols(8bits) No. subchannels(6bits)	

			}	

11.4 DCD management message encdings

11.4.1 DCD channel encodings

[Change Table 358 in 11.4.1 "DCD channel encodings", as shown:]

Table 358-DCD channel encoding

Name	Type (1 byte)	Length	Value(variable length)	PHY scope

DL region	34	*variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Demod+dec region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Demod region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Mod region	?	*Variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	

Enc+mod region	?	*variable*	Num region(6bits for the number of regions, 2 bit reserved) For (i=0; i< Num region; i++){ OFDMA symbol offset(8bits)	

			subchannel offset(6bits) No. OFDMA symbols(8bits) No. subchannels(6bits) }	

Gap region	?	*variable*	Num region(6bits for the number of regions, 2 bit reserved)
			For (i=0; i< Num region; i++){
			OFDMA symbol offset(8bits)
			subchannel offset(6bits)
			No. OFDMA symbols(8bits)
			No. subchannels(6bits)
			}	